

**John Valley**

Charles R. Van Hise Professor  
University of Wisconsin, Madison

**Hadean Zircons are not from Hell: Evidence from Atom Probe Tomography and SIMS**

SIMS analysis of terrestrial zircons ( $ZrSiO_4$ ) yields U-Pb ages nearly as old as the Earth, but these Hadean Eon ages (4000 – 4400 Ma, million years ago) have been challenged as possibly biased by mobility of Pb atoms. Questions about “Pb-migration” have plagued U-Pb geochronology for over 100 years and were first resolved at atomic scale in 2014 by APT of a 4374 Ma zircon that shows clustering of radiogenic Pb. These new results show that unaltered domains in zircon with low degrees of radiation damage can be recognized, strengthening the interpretation, based on oxygen isotopes, that most of the Hadean Eon was not “hell-like” as commonly believed and implied by the name. The earliest Earth was indeed hot, violent and inhospitable at 4500 Ma, but by 4300 Ma its surface had cooled and the steam atmosphere condensed to form habitable oceans. Thus, it’s possible that life emerged almost 1 billion years earlier than the oldest known microfossils.